OPERATING INSTRUCTIONS

GA08216_0102

PT 70 F-Compact

Dry Turbomolecular Pumping System

Part Numbers

500 002 471

500 002 472

Leybold
vacuum

Contents

1 Description

1.1 Ordering data

Standard System Part Numbers

PT70 F-Compact, 63 ISO-K Inlet	500 002 471
PT70 F-Compact, 63 CF Inlet	500 002 472

Items Included

PT70 B-Compact System

Input Power Cord, 230 V/1ph/50 Hz, 2m Long

Operating Instructions (this manual)

TW70H Turbopump manual (GA 05145)

Turbopump splinter guard

Applicable Equipment (ref. Leybold Catalog)

Turbopump:

TW70H-CF63	800002V2236
TW70H-DN63ISO-K	800002V1236

NOTE: These standard part numbered pumps are supplied with a KF16 foreline port. The PT70 F-Compact system uses an 8mm OD tube fitting in place of the KF16 port. The part number of the 8mm OD tube fitting used for the foreline port of the TW70H is 72550105 (refer to the spare parts list). The KF16 port must be removed and this fitting used in its place to allow the foreline tubing to be connected.

Forepump, DIVAC 0.8T (24VDC)	72292016
Vent valve, Leybold 24VDC, normally closed	72053113

System Sensors, inlet

ITR090 Combination Ion/Pirani

KF25, with integral display readout	12091
KF25, without display.	12090
CF40, with integral display readout	12094
CF40, without display	12092

Accessories (ref. Leybold Catalog)

System Sensors, inlet (optional)

NOTE: For automatic sequencing, either an inlet **or** foreline sensor must be installed in the system!

ITR90 Combination Pirani/Hot Cathode Ionization:

KF25, with integral display readout	12091
KF25, without display.	12090
CF40, with integral display readout	12094
CF40, without display	12092

Foreline (optional):

TTR090 Thermovac 1/2” Tube O.D.	12813
Vent valve, Leybold 24VDC, normally closed	72053113

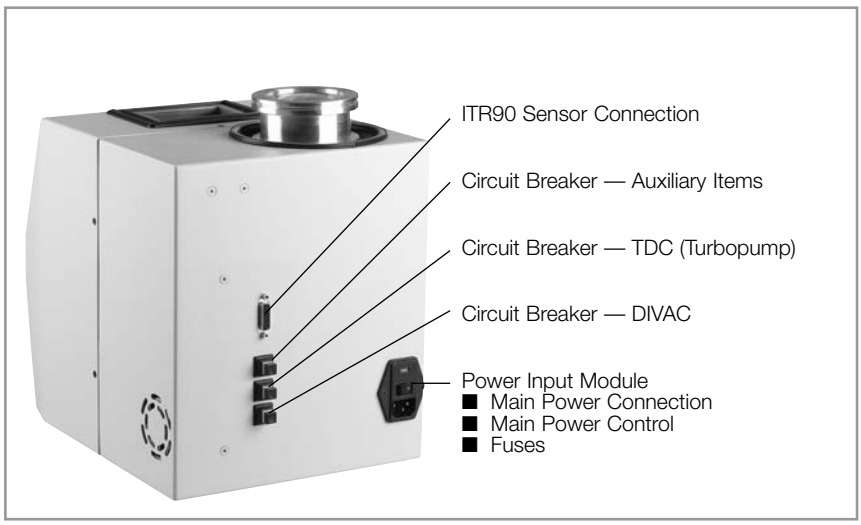
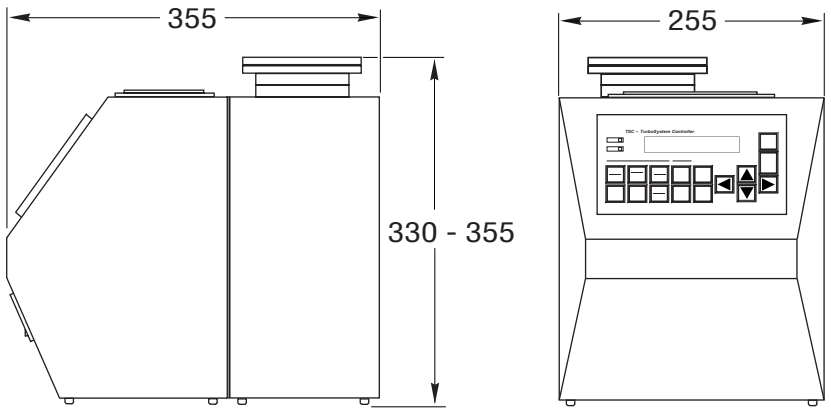


Fig. 1 Rear view

1.2 Technical Data

Power Input	88-132 or 176-264V/1ph/50-60Hz AC
Main fuses	5 or 10A depending on supply voltage
Auxiliary (24VDC) circuit breakers	
TDC	10A
DIVAC	4A
Auxiliary Power	3A
Power/Current Consumption, 24VDC	
Turbopump (max.)	170W
Fore/Rough Pump (max.)	34VA
Vent valve	7W
ITR090 Sensor (max.= degas)	20W
TTR090 Sensor	<1W
Control Inputs, analog	
System vacuum sensor	0-10VDC
Control Outputs, powered, 24VDC	
Vent valve	< 0.5A
Environment	
Temperature	0 - 45°C
Humidity	5 - 95%, non-condensing
Weight	14.5 kg



The actual overall height depends on the type of the turbopump.

Fig. 2 Dimensional drawing, dimensions in mm

1.3 Background

The Leybold PT70 F-Compact system is an integrated unit that features a TW70H Turbopump and a DIVAC 0.8T diaphragm backing pump. There are two versions of the system: a Manual, Basic (“PT70 B-Compact”) and a Full-Featured (“PT70 F-Compact”) system. There are several differences between the two packages:

Controls

The PT70 B-Compact version allows only manual operation using rocker switches on the system’s front control panel. The PT70 F-Compact version features a “one-button” automated control sequence as well as manual control plus informational feedback on the system’s status and pump operations.

Pressure Display

The PT70 F-Compact version provides power and a readout for an ITR90 Combination Pirani and Bayard-Alpert Hot Cathode Ionization sensor. While the PT70 B-Compact version also powers an ITR90 sensor, it provides no display readout of the pressure on the control panel. It is recommended that the PT70 B-Compact version use the ITR90 sensor that includes the integral display. The PT70 F-Compact version may use either this sensor or one without the integral display. Some users require the local readout on the system controller due to the mounting location of the sensor while for others the sensor with the integral display is acceptable.

Foreline Sensor

The PT70 F-Compact version can also include an optional smart foreline sensor (Pirani — TTR 90) and will display the pressure from this sensor on the PT70 B-Compact's front control panel. The PT70 B-Compact version cannot accommodate a foreline sensor.

NOTE: To operate the PT70 F-Compact version in Automatic mode, either a foreline or inlet sensor must be installed!

While there are differences in the controls and display of pressures, the two versions include common features. Both systems use the TW70H turbopump and a 24VDC version of the DIVAC 0.8T diaphragm forepump. Both pumps are driven by 24VDC motors. The TW70H uses a Turbo.Drive controller ("TDC") to interface with the pump and the power supply.

The TDC also acts as a communication interface to provide a means for obtaining operational information from the turbopump. Information on the pump's rotational speed, current draw, temperatures, etc., is available via the system's front panel display (on the PT70 F-Compact system only — the PT70 B-Compact system has no display or readout). In addition, the last error experienced by the TW70H is available from the control panel.

The pumps are enclosed in a sturdy two-piece sheet metal housing. The turbopump is attached to the enclosure via four socket head screws at its bottom surface and may be removed for remote mounting. The foreline is 8 mm diameter polyethylene tubing. It is used with compact press-in fittings for ease of changing the foreline when the turbopump is moved to a remote mounting location. The forepump is mounted on vibration isolation mounting feet and includes an exhaust silencer to reduce noise levels during roughing of the volume to be pumped down.

The typical noise level of an operating system is <55 dB(A).

A two meter power cord is supplied as standard. Longer lengths are available on request. The system is supplied for operation on a nominal 220 V/1ph/50 Hz supply. The power supply used in the PT70 F-Compact system is autoranging over two specific ranges: 88-132 and 176-264 volts. Since all of the items included in the PT70 F-Compact system operate at 24VDC, any supply voltage within either of these two ranges is suitable for powering a PT70 F-Compact system.

2 Connections

Warning

Never expose any parts of the body to the vacuum.

The turbomolecular pump shall be solidly mounted. If the mounting is not sturdy enough, blockage could cause the pump to break loose; internal pump components could be thrown in all directions. Never operate the pump (in bench testing, for example) without proper flanging.

The pump system shall be operated only at the line voltage specified on the data plate.

After a mains power failure the pump can run up automatically once more.

If the pump has previously handled hazardous gases, implement the proper precautionary measures before opening the intake or exhaust connection.

If necessary, use gloves, a respirator and/or protective clothing and work under an exhaust hood.

Caution

The turbomolecular pump systems are not suitable for pumping dusty, aggressive or corrosive media.

Never operate the diaphragm pump with a sealed or narrowed exhaust port.

The turbomolecular pump may be moved only when not in operation.

Exposure of the pump to accelerating forces must be avoided or reduced to such an extent that the rotor unit will not be excited by vibrations. In the case of critical applications you must consult our Applications Dept. first.

The pump must only be opened by such persons who have been authorised by Leybold to do so.

2.1 Power

There is one connection point just above the right bottom edge of the rear of the enclosure that the power cord plugs into to provide main power to the system. This main power input connection is a recessed three-pron male connector. The system's power (On/Off) is controlled by the rocker switch just above the main power input receptacle on the rear of the enclosure. The fuses for short-circuit protection are contained in a module behind the drop-down cover on the power input module.

The power input for the PT70 F-Compact is nominally 220 V/1ph/50 Hz. Other supply voltages in the range of 88-132 V or 176-264 V are also suitable. The system's power cord is supplied as standard at a two meter length. Other lengths are available on request.

2.2 Accessories

ITR 90 Combination Pirani/Bayard Alpert Hot Cathode Ionization Sensor

There is a connection point on the rear of the PT70 F-Compact system enclosure for an inlet sensor. It is a DB15 female connection and is used to connect an ITR 90 Combination Pirani/Bayard Alpert Hot Cathode Ionization sensor. The connecting cable is available in various lengths from stock. The five meter cable length is shipped as standard. Other lengths are also available on request.

TTR 90 Pirani Sensor

An optional TTR 90 sensor may be installed in the foreline manifold. (The blanking plug must first be removed from the 1/2" tube diameter port on the foreline manifold. This is done by pressing down on the green ring around the outside of the fitting and pulling out on the plug. The TTR90 sensor is installed by pressing it down into the fitting until it "bottoms out".) The mating connector for power and signal input to the controller is installed in the enclosure at the factory. Simply plug it into the mating receptacle on the sensor. The cable has an RJ45 connector on one end (similar to a telephone connector).

Vent Valve

An optional normally closed vent valve may also be installed in the foreline manifold. (As noted for the TTR90 Pirani sensor, a blanking plug must first be removed from the 8mm tube diameter port.) The mating connectorand power cable for the valve is installed at the factory inside the unit for connection of the 24VDC power leads.

The vent valve — ready for plug-in — may be purchased from Leybold. Refer to the accessory listing for part number information.

The system is designed to use a normally closed 24VDC vent valve as standard. Due to the operation of the controller, a normally open vent valve may not be suitable for use with the system. Please consult the factory if it is desired to use a normally open vent valve with the PT70 F-Compact system.

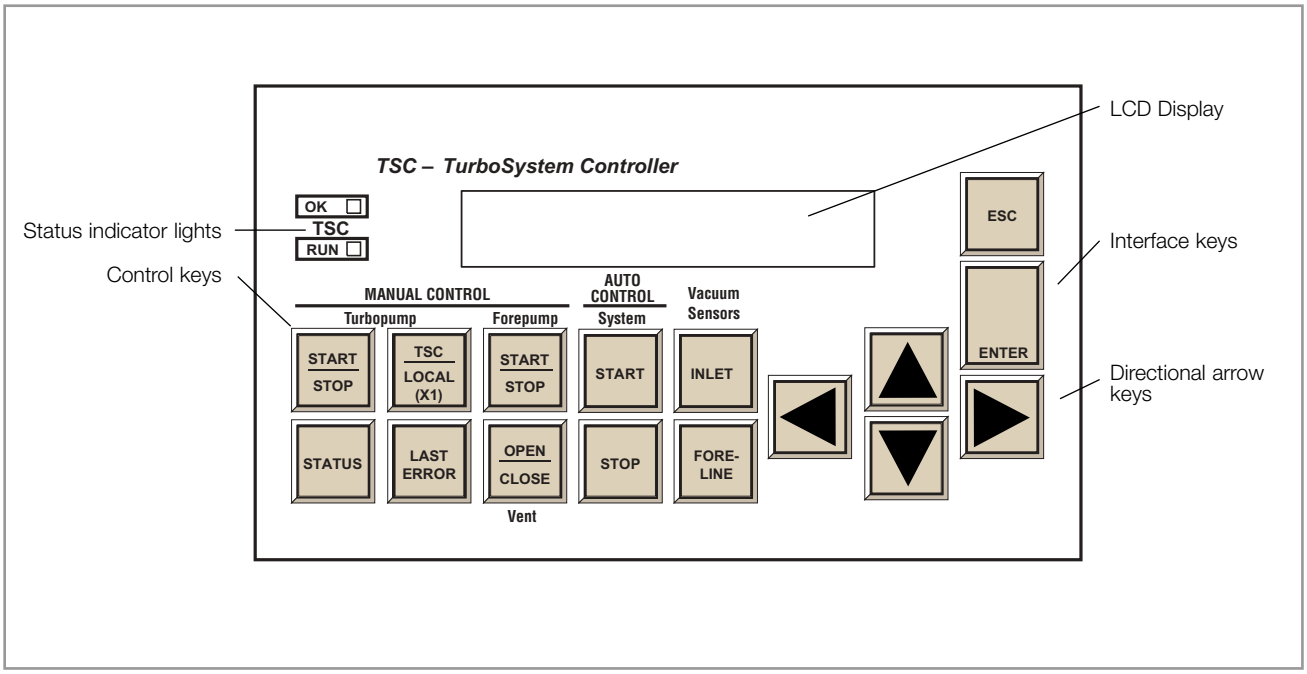


Fig. 3 Front panel

3 Operation

3.1 Operator Panel Overview

The front panel of the PT70 F-Compact system controller is shown above. It consists of a two-line alphanumeric LCD screen, 10 control keys, four directional arrow keys, two interface keys, and two status indicator lights.

The status indicator lights indicate the current state of the controller. The top light indicates whether the controller itself is functional and the bottom indicates that the controller is in the “run” mode. In normal operation, both indicator lights on the controller are illuminated. If the controller were to fail, the top “OK” light would go out. The bottom light is always illuminated unless the controller is being programmed.

The two-line alphanumeric LCD display screen is used to provide updates on the system’s status as well as operational information on the turbopump. It is also used in conjunction with the control keys and menus to display alternative choices for the user.

The directional arrow keys are used to access the various options on the control menus and to scroll through the various selections.

The interface keys are used to make selections on the control menus.

The control keys provide the main means to control the turbopump and system components (forepump; vent valve), plus select the various alternate display and operation choices. A brief overview of these keys and their functions follow.

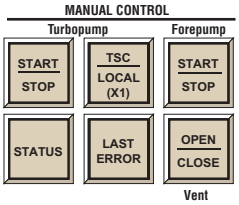
3.2 Control Key Summary

The PT70 F-Compact System has two control modes: Automatic and Manual. Automatic is the default. Manual is chosen by making a selection via the STATUS menu (This is described in Section 4.3.) Under automatic control, there is only one pushbutton required to start or stop the pumpdown sequence. With manual control, each pump or component is controlled individually by the operator.

The AUTO CONTROL— System START control key is used to initiate the automatic pumpdown sequence of the vacuum system. This key is functional only when in the Automatic mode. When this key is pressed, all actions of the system are under the preprogrammed control of the PT70 F-Compact's controller. No other keys are active except for the informational keys: Vacuum Sensors and Turbopump STATUS.

The AUTO CONTROL— System STOP control key is used to stop the automatic pumpdown sequence. This key is also only functional when in the Automatic mode. When this key is pressed, the system is brought to a stop via a pre-programmed sequence.

Details of the actions when these keys are pressed are given on page nn.



As noted above, manual control allows the operator to start/stop or open/close all system components individually.

The MANUAL CONTROL—Turbopump—START/STOP key allows the operator to start and stop the turbopump. By default, it is "stopped" upon switchover to manual mode.

The Forepump—START/STOP key allows the operator to start and stop the DIVAC. By default, it is "off" upon switchover to manual mode. Pressing the key one time will start the DIVAC. Pressing the key a second time will stop the pump.

The Vent—Open/Close key allows the operator to open and close the optional vent valve. The vent valve is supplied when ordered as a normally closed valve. Pressing the key the first time will energize and open the vent valve. Pressing the key a second time will de-energize and close the vent valve.

The STATUS key allows the operator to determine operational information about the turbopump as well as change the control mode between automatic and manual and change the displayed pressure unit of measure and operational parameters.

The available turbopump-specific information includes pump type; rotational speed and frequency; bearing, motor, and TDC temperatures; motor current; TDC supply voltage; and system operational hours.

Control mode choices are automatic (the default) and manual. Refer to Section 4.3 for information on changing modes.

Pressure units of measure available include torr, mbar, or Pascal (Pa).

The LAST ERROR key allows the operator to query the turbopump/TDC for the last operational error that it experienced that caused it to go into "failure" mode. Refer to Section 4.7 for further details.

The TSC/LOCAL (X1) key allows the operator to switch control of the turbopump from the PT70 F-Compact controller to direct control at the TDC (Turbo.Drive). (This would normally only be done for troubleshooting purposes.) The PT70 F-Compact Controller allows two methods of turbopump control: “TSC” or “LOCAL (X1)”.

TSC is control via the keys of the system controller. LOCAL (X1) is control directly via the “X1” connector on the TDC frequency controller — bypassing the system controller. When in LOCAL (X1) mode, the Turbopump—

Start and Stop keys are not active. All other keys remain functional.

LOCAL (X1) control is via the 9-pin sub-D connector (designated “X1”) on the pump’s TDC. When in this mode, the turbopump can only be started and stopped by contact closures on pins 7 and 8 of the TDC’s sub-D connector as detailed in the turbopump’s operating manual. It cannot be started and stopped by the system controller’s START and STOP keys when in LOCAL (X1) mode.

On initial power-up, the controller sets the system to TSC — Automatic mode.

The Vacuum Sensors—Inlet key allows the operator to view the pressure readings of the ITR90 Combination Bayard-Alpert Hot Cathode Ionization/ Pirani sensor and also perform a degas of the hot cathode sensor when desired.

The Vacuum Sensors—Foreline key allows the operator to view the pressure readings of the optional TTR90 Pirani sensor mounted in the foreline.

A warning message is displayed if a sensor is either not connected (“N/C”) or is not functional (“Error”).

3.3 Program Interlocks

There are several interlocks built into the system controller to prevent incorrect or inadvertent operation of the system. These include the following:

1. The DIVAC forepump cannot be started if the vent valve is open.
2. Likewise, the vent valve cannot be opened if the DIVAC is running.
3. The TW70H turbopump cannot be started unless the DIVAC is running.
4. The automatic pumpdown sequence cannot be started if there is no inlet or foreline gauge connected or they are non-functional.
5. The automatic pumpdown sequence cannot be started if the vent valve is open.
6. The inlet Combination Pirani/Bayard-Alpert Hot Cathode Ionization Sensor cannot be degassed if the pressure is greater than 5.4×10^{-6} torr.
7. It is not possible to switch between TSC and LOCAL (X1) modes if an automatic pumpdown sequence (start or stop) has been initiated.
8. The STATUS menu has to be exited fully to change between the TSC and LOCAL (X1) control modes.

3.4 Menus and Sub-menus

The menu that is accessed by pressing the STATUS key displays information on a line-by-line basis. There are also sub-menus (“Change Mode” and “Press./Units”) on the STATUS menu that operate in a similar manner. To read the entire menu, the arrow keys (“▲” and “▼”) are used to scroll up and down the menu structure. A cursor (“→”) is displayed at the left margin of each line to indicate which of the two lines displayed is “active”. To make a selection, the “ENTER” key is pressed when the cursor is displayed next to the line that contains the desired selection.

All menus and sub-menus may be scrolled either up or down. The menu will wrap to the bottom or top, respectively,when the first or last line is reached and the same directional (arrow) key is pressed again.

Exiting Menus and Sub-menus

There are two methods of exiting a menu or sub-menu:

- Pressing the “ENTER“ key when the cursor is on the ”ENTER = Return“ line.
- Pressing the “ESC“ key.

3.5 Automatic Operation Sequence

Note that the Automatic mode requires either a functional foreline or inlet sensor. Without either, the automatic program will not function!

Upon startup, the system is set to Automatic mode. However, in order for the turbopump to start, its starting pressure must be entered by the user. This is done via a submenu selection on the STATUS menu. Refer to Section 4.4 for details on how to access and set this pressure.

Once in AUTO mode, pressing the AUTO CONTROL—System—Start key will start the system:

1. The Diaphragm Pump is STARTED.
2. When the pressure (as measured by the foreline Pirani — or inlet ITR 90 sensor if a foreline TTR90 is not installed) is less than the set starting pressure, the TW70H is STARTED.

When in the AUTO mode, pressing the AUTO CONTROL/System Stop key will stop the system:

1. The TW70H is STOPPED.
2. The Diaphragm Pump is STOPPED.

There are time delays built into the automatic controls between each step listed above to avoid any overlap between actions.

3.6 Manual Operation Sequence

Manual Mode

To operate the individual components manually, the controller must be in the MANUAL mode. To switch to MANUAL mode, a selection is made via a submenu on the STATUS menu. See Section 4.3 for details on how this is done.

Once in MANUAL mode, each pump or component acts according to the status of the keypad inputs. Pressing the key once will initiate the action as labeled by the key's upper line (valve opens, pump starts, etc). A second

press of the same key will initiate the action as labeled by the key's lower line (valve closes, pump stops, etc).

Startup

Once connected to the volume to be pumped down, the DIVAC is started by pressing the "Forepump—Start/Stop" key. The DIVAC will start and begin roughing out the volume. If the optional foreline TTR90 vacuum sensor is installed, the pumpdown can be monitored until the pressure is in the range of 5 to 10 mbar or so. At this point, the turbopump can be started by pressing the "Turbopump—Start/Stop" key. If the optional sensor is not installed, then a suitable time delay should be used between starting the DIVAC and the TW70H to allow the pressure to drop to an acceptable level. This time delay will depend on the volume to be pumped down and must be determined by the end user.

Turbopump starting pressures up to atmospheric pressure are possible. The actual starting pressure to be used will depend on the size of the volume to be pumped down. Generally, if the foreline pressure can be brought down to less than about 10 mbar within the time it takes the turbopump to reach normal operating speed (1200 Hz/72000 rpm), then the turbopump can be started at the same time as the DIVAC. (The TW70H is required to reach normal operating speed within 6 minutes or it will shut itself down to protect itself.) A chart is provided in the TW70H Operating Instruction manual (GA 05.145) that can be used as a guide to determine its starting pressure.

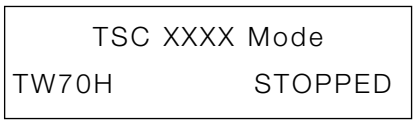
Shutdown

The TW70H can be shut down by pressing the "Turbopump—Start/Stop" key a second time. The DIVAC can also be stopped at this time by pressing the "Forepump—Start/Stop" key a second time. If an optional vent valve is installed, it can be energized to open (normally closed valve) and vent the turbopump to atmospheric pressure to shorten the time it takes for the turbopump to come to a fully stopped state. The rate of pressure rise should conform to the venting guidelines as noted in the TW70H's Operating Instruction manual (GA 05.145).

The optional Leybold electromagnetic vent valve includes an orifice sized to meet these requirements when venting the turbopump and foreline. Venting of a connected volume at the same time will take longer, but the allowable rate of pressure rise will still be met. (A vent valve with a larger orifice is available as a special order item.)

3.7 Status Display Overview

On initial power-up, the PT70 F-Compact controller alternates between two displays. The first shows the current control mode, the type of turbopump that is connected, and its current operational status. The second shows a brief overview of the system to indicate the status of the system.

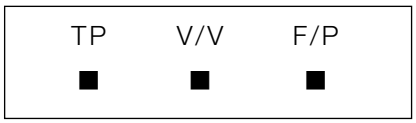


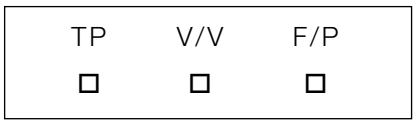
The first screen indicates the current mode of control (“TSC XXXX” or “X1“) on the first line, and the turbopump

type and its operational status on the second line. (The “XXXX” would be replaced with either “AUTO” or “MANL” depending on the TSC operating mode selected.) Here, the example shown on the left, above, indicates that the controller is active (“TSC XXXX Mode”) and that the connected pump is a TW70H model. Currently, its status is stopped. The example on the right shows the display when in X1 control mode under the same conditions.

In TSC MANL mode, if the START pushbutton were pressed, the turbopump would start. Internally, the turbopump’s frequency controller checks for proper rotation, and begins to accelerate the pump. The “STOPPED” indication on the display changes to “STARTED”. Once the turbopump indicates that it has begun to turn at a rate greater than 1 Hz, the display is updated to show that the pump has entered acceleration mode (“ACCELERATING”). When the pump has reached normal operation speed, the display is changed to indicate this (“NORMAL OPER.”).

Once the pump has been told to stop, the display changes to “DECELERATING” to indicate this. The rotational speed of the pump can be monitored via the STATUS menu and can be displayed during acceleration, normal operation, or deceleration. Once the pump’s rotational speed has dropped below 1 Hz, the screen indicates that the pump has “STOPPED”. The display screen is updated approximately once every second.





The second screen gives a brief overview of the state of the system. It features abbreviations for each of the system’s major components on the first line and corresponding status blocks on the second.

Abbreviations used are: TP = Turbopump V/V = Vent Valve F/P = ForePump

The second line consists of blocks that are either outlined or filled-in (as shown above). If outlined, this means the corresponding component is in its deenergized state — pumps are off and/or the optional vent valve is in its closed position. If filled-in, this means the corresponding component is in its energized state — pumps are on and/or the optional vent valve is open.

In the case of the forepump, it is noted as being started (block filled-in solid) as soon as the Forepump—START/STOP button is pressed — since there is no feedback from the pump confirming that it has truly started to rotate. For the turbopump, its indicating block is filled as soon as the pump’s rotational speed has exceeded 1 Hz. The vent valve is indicated as energized as soon as the Vent—OPEN/CLOSE pushbutton is pressed.

These status blocks, then, are not always a true indication of the actual component's status. The forepump will always only indicate that it should be either off or running. Since there is no feedback from the actual forepump, the indicating block in the display can be misleading if this is not taken into account. The status of the turbopump will always be true to its actual state since its rotational speed feedback determines the indicating block's status. The indicating block for the vent valve will always only indicate that the controller's output is energized or deenergized.

3.8 Operation Considerations

Operation upon a power failure

The PT70 F-Compact system will restart after a power loss. The controller used is retentive and will attempt to return the system to its previous state after power is reestablished.

If it should be desired to not have an automatic restart of the system after a power loss, please contact the factory for information regarding this special case.

Resetting a fault condition

In order to clear an indicated error and allow the turbopump to be restarted, power must be removed from the turbopump. This means that the turbopump must come to a stop. This is due to the turbopump's tendency to act as a generator upon loss of power. When power is removed, the voltage generated internally by the turbopump keeps the frequency controller ("TDC") powered. Only when the frequency controller loses this power is the fault condition reset, allowing the turbopump to be restarted. (Note that the error condition is retained in non-volatile memory in the TDC and may be accessed via the PT70 F-Compact controller's "LAST ERROR" key.)

Also, on shutdown, the PT70 F-Compact system must remain off for at least five seconds. This will allow sufficient time for the power supply to dissipate any residual voltage and reset the controller to initial starting conditions.

4 Screens

4.1 Main Display Screens

Mini-OCS--NoNet Self-Test Running

Screen 1

The controller performs self-diagnostics on power-up.

Changes to screen 2 when diagnostics are completed.

** Self-Tests ** **** Passed ****

Screen 2

Indicates that the controller is functioning properly.

Changes to screen 3 when diagnostics are completed. “OK” and “RUN” indicating lights on controller front pane are lit when self-tests are passed.

PT70 F-Compact Full-Featured V1.02

Screen 3

An introductory screen is displayed after the self-check iscompleted.

Shown for 5 seconds then changes to screen 4.

TSC XXXX Mode TW70H STOPPED

Screen 4

Displays the current control mode, pump model, and the operational status. TSC control is the default mode.

Alternates with screen 6. Shown for three seconds then changes to screen 6. Shown until the control mode is changed to “X1“ then changes to screen 5.

X1 Control Mode TW70H STOPPED

Screen 5

Displays the current control mode, pump model, and the operational status. X1 control requires operator input t select.

Alternates with screen 6. Shown for three seconds then changes to screen 6. Shown until the control mode is changed to “TSC“ then changes to screen 4.

TP	V/V	F/P
□	□	□

Screen 6A — All indicators “OFF”

Displays the current status of the turbopump, vent valve, and forepump.

Depending on whether the system components have been energized, the blocks below the equipment abbreviations are either empty (“OFF”: pump stopped, valve deenergized) or filled-in (“ON”: pump started, valve energized). Any combinations of empty or filled-in blocks are possible, not just those shown.

TP	V/V	F/P
■	■	■

Screen 6B — All indicators “ON”

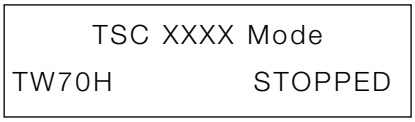
Alternates with screen 4 or 5, depending on the current control mode in effect. Shown for eight seconds then changes to screen 4 or 5.

The following screens are all based on the same screen — Screen 4. The only difference among these screens is the operational status. These screens show the different conditions possible and their associated indications.

Also listed are the requirements to activate each screen in the MANUAL and AUTOMATIC modes.

The turbopump has finally stopped after pressing the "Turbopump—START/STOP" or the "AUTO CONTROL-System STOP" key, or after initial power-up (i.e., the default screen prior to any operator actions.)

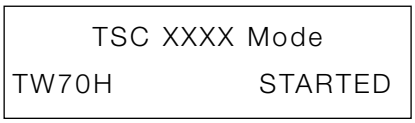
Displayed when the turbopump's rotational speed is less than 1 Hz.



Screen 7

The turbopump has been started by pressing the "Turbopump—START/STOP" key or the "AUTO CONTROL—System START" key.

Displayed as long as the turbopump's rotational speed is less than 1 Hz.



Screen 8

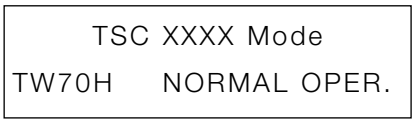
The turbopump has been started by pressing the "Turbopump—START/STOP" key or the "AUTO CONTROL—System START" key.

Displayed as long as the turbopump's rotational speed is greater than 1 Hz and less than Normal Operation speed.

Screen 9

The turbopump has been started by pressing the "Turbopump—START/STOP" key or the "AUTO CONTROL—System START" key.

Displayed when the turbopump's rotational speed is greater than or equal to 1080 Hz — Normal Operation speed.



Screen 10

The turbopump has been stopped by pressing the "Turbopump—START/STOP" key or the "AUTO CONTROL—System STOP" key.

Displayed as long as the turbopump's rotational speed is greater than 1 Hz.

Screen 11

The following screens are also based on one screen — Screen 5. Again, the only difference among these screens is the operational status. These screens show the different conditions possible and their associated indications while control is in the X1 mode. Since the PT70 F-Compact controller is not used to start or stop the turbopump, it can only determine whether or not the turbopump is rotating and if the turbopump has reached normal operation speed. Thus, only two different displays are available in X1 mode.

The turbopump has been started in X1 mode by connecting — or is in the process of stopping by opening — pins 7 and 8 on the turbopump's "X1 REMOTE" connector.

Displayed when the turbopump's rotational speed is less than Normal Operation speed.

Screen 12

The turbopump has been started in X1 mode by connecting pins 7 and 8 on the turbopump's "X1 REMOTE" connector.

Displayed when the turbopump's rotational speed is greater than or equal to Normal Operation speed.

Screen 13

4.2 STATUS Display Screens

The STATUS key is used to access a menu that is used to provide operating information on the turbopump and vacuum system. Additionally, other sub-menus are accessible from this menu (covered in Section 4.3).

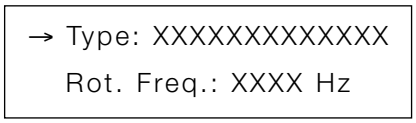
The “STATUS” key provides a scrolling list of information about the turbopump’s operation. As shown in the display screen samples at left and on the next page, these items include the pump’s:

1. Type (e.g., “TW70H“)
2. Rotational frequency (e.g., ”1200 Hz“)
3. Rotational speed (e.g., 72000 RPM”)
4. Bearing temperature (e.g., “35°C“)
5. Motor current draw (e.g., ”4.5A”)
6. Motor temperature (e.g., “42°C“)
7. Controller supply voltage (e.g., ”24 VDC“)
8. Converter heatsink temperature (e.g., ”40°C“)
9. Total operating hours (e.g., ”21.3”)

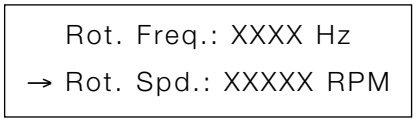
The information in this menu may be viewed by scrolling up or down the list by using the “arrow” keys (“▲” or “▼”). A cursor is displayed at the left of the current line in the display. The cursor is an arrow pointing to the right.)

These items are displayed on a two-line basis. Reference Screen 15 and following. (The cursor is on the top line of Screen 14 when the STATUS menu is entered, so that on the first press of the “down” arrow key, the cursor merely moves to the second line of information.)

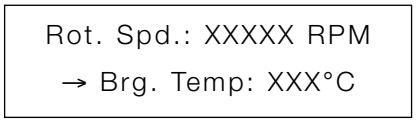
As you scroll down, the first line is replaced with what was the second line and a new line of information is displayed on the second line. This is shown in the listing at left where the display screens are shown simulating moving down the list. (Screen 14 is the initial screen displayed when the “STATUS” key is pressed.) Scrolling up works in a similar manner, except that what was the first line is shifted down and is replaced with the new information.



Screen 14

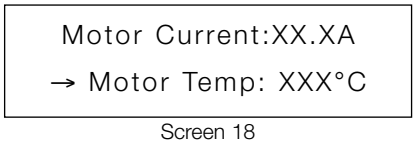


Screen 15

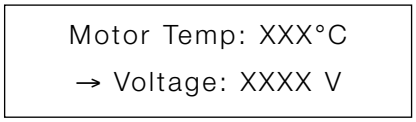


Screen 16

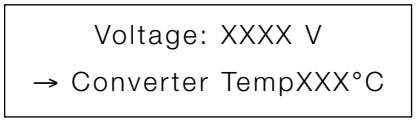
Screen 17



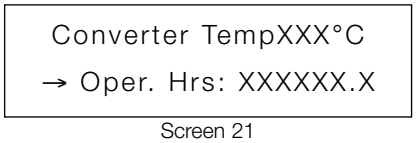
Screen 18



Screen 19



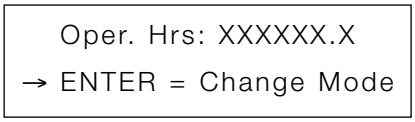
Screen 20



Screen 21

Change Mode Sub-menu: (Screen 22)

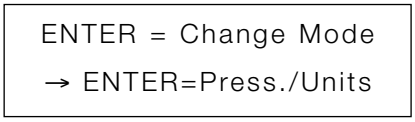
This sub-menu allows the operator to switch control from automatic to manual and vice versa. Pressing the ENTER key when the cursor is on the line shown will bring up the CHANGE MODE sub-menu described in Section 4.3.



Screen 22

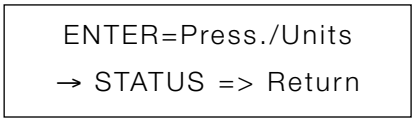
Press./Units Sub-menu: (Screen 23)

This sub-menu allows the operator to set the pressure levels for turbopump control and choose the units displayed. Pressing the ENTER key when the cursor is on the line shown will bring up the PRESSURE UNITS sub-menu described in Section 4.4.



Screen 23

This list also “wraps” at the beginning and end of the list. That is, when scrolling down and reaching the last item in the list (“STATUS => Return“), another press of the down arrow brings the cursor back to the top of the list and displays the first line of information (”Type“) on the new line.



Screen 24

Likewise, when scrolling up, upon reaching the first item in the list (”Type“) and pressing the up arrow again, the las line of information is displayed (”STATUS => Return“) on the new line.

The last screen line (“STATUS => Return”) is used to advise how to exit the STATUS menu. The Escape key (“ESC”) may also be used to exit a menu or sub-menu.

4.3 CHANGE MODE Sub-menu Display Screens

Oper. Hrs: XXXXXX.X
→ ENTER = Change Mode

(For reference: Screen 22)

Pressing the ENTER key when the cursor is on the "ENTER = Change Mode" line switches to a sub-menu that shows the current operational mode of the controller (manual or automatic) and allows this mode to be changed.

Upon entering the sub-menu, the first line displays the current operating mode ("AUTO" or "MANL").

In AUTO mode, a pumpdown sequence may be initiated by pressing the "SYSTEM—AUTO START" key or a return to the initial "off" state may be initiated by pressing the "SYSTEM—AUTO STOP" key.

In MANL mode, all pumps and valves are controlled by their individual control keys.

→ Current Mode: XXXX
ENTER = XXXX Mode

Screen 25

The second line allows the operating mode to be changed by pressing the ENTER key when the cursor is on the line a shown in Screen 26.

Prior to changing modes, the following conditions must be met:

Current Mode: XXXX
→ ENTER = XXXX Mode

Screen 26

- the turbopump must be OFF,
- the turbopump must have come to a complete stop,
- the Fore/Rough pump must be OFF, and
- the vent valve must be in its de-energized state.

ENTER = XXXX Mode
→ ENTER = Return

Screen 27

Pressing ENTER when the cursor is on the line shown in Screen 27 will return to the STATUS main menu, line 1.

4.4 Press./Units Sub-menu Display Screens

(Pressing the ENTER key when the cursor is on the “ENTER=Press./Units” line switches to a sub-menu that shows the current pressure settings for the automatic pumpdown mode and allows these values to be changed.

ENTER = Change Mode
→ ENTER=Press./Units

(For reference: Screen 23)

Upon entering the sub-menu, the first set of lines (Screen 28) display the current starting pressure for the turbopump. This is the pressure that must be achieved before the turbopump will be started in the automatic pumpdown mode. If the optional foreline sensor is installed, the pressure is taken from it. If not, the pressure used is from the inlet ITR90 sensor.

→ TMP Start Pressure:
5.0 mbar

Screen 28

The second set of lines (Screen 29, reached by scrolling down two lines) allows the turbopump’s starting pressure to be changed. By pressing the ENTER key when the cursor is on the line indicated, the set of “less than” characters (“<<<<<<”) changes to zeroes as shown in screen 30. The last zero switches between a zero and a solid block (as shown) to indicate that a new pressure may be entered.

The factory setting for the turbopump’s starting pressure is 5 mbar.

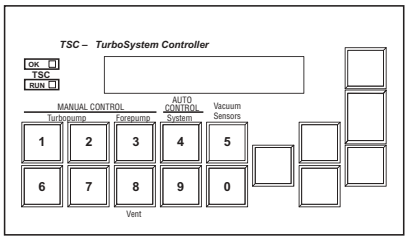
Enter New Start P:
→ <<<<<≤ mbar

Screen 29

Enter New Start P:
→ 0.00■ mbar

Screen 30

Numbers are entered by using the control keys. There are two rows of control keys. The first row is 1 through 5 and the second row is 6 through 9 with the fifth key being a 0. A decimal point may be entered by pressing the “down” arrow key. The numeric layout is as shown at left.



After entering the turbopump starting pressure, by scrolling down, the lines shown in Screen 31 appear and list the current pressure that the foreline can rise to before the turbopump will be shut off.

Screen 31 shows the display for the turbopump’s maximum foreline pressure. Scrolling down two more lines, Screen 32 appears and allows the value to be changed. Changing the value is done in the same manner as for the turbopump’s starting pressure: press the ENTER key when the cursor i on the line as shown in Screen 32, enter the new pressure using the controller’s numeric keys, and press the ENTER key when the new value has been entered. The new value is then accepted.

The factory setting for the maximum foreline pressure is 10 mbar.

→ Maximum Fore Press:
10.000 mbar

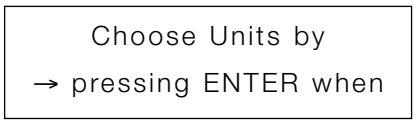
Screen 31

Enter New Maximum:
→ 10.00■ mbar

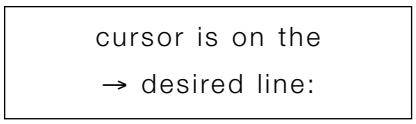
Screen 32

Scrolling down from the maximum foreline pressure input line brings up a means of selecting the desired pressure units. Choices are torr (the default), mbar, and Pascal (Pa).

Screens 33 through 36 show descriptive text for selecting the pressure display units. Screens 35 and 36 list the available units (torr, mbar, and Pa). Mbar is the default unit. Select an alternate unit by pressing the ENTER key when the cursor is on the appropriate line.

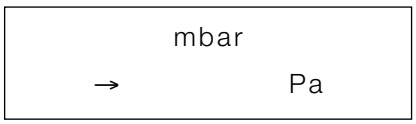


Screen 33

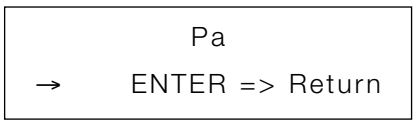


Screen 34

Screen 35



Screen 36



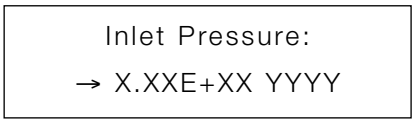
Screen 37

Screen 37 indicates that pressing the ENTER key when the cursor is on the “ENTER => Return” line in the sub-menu wil return the display to the STATUS main menu, line 1.

4.5 Vacuum Sensors—Inlet Sub-menu Display Screens

The “Vacuum Sensors—Inlet“ key is used to display the inlet pressure and access a sub-menu whereby the hot cathode ionization sensor may be degassed.

The first information displayed on pressing the Vacuum Sensors—Inlet key is the current pressure as measured by the ITR90 Inlet sensor. The pressure is displayed in scientific notation (“X.XXE+XX” as shown at left in Screen 38) in the selected units (“YYYY”).



Screen 38

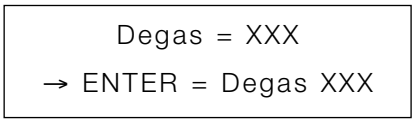
There are two readouts possible with the sensors: the actual pressure or an error message.

With an actual pressure reading, the “X.XXE+XX” as shown in the displays at left is replaced with the actual pressure measured by the ITR90 sensor. The actual pressure is always displayed in scientific notation.

If the sensor is not connected to the controller or there is a problem with the sensor, the display changes to a Warning Screen (see Section 4.8).

Should the pressure be outside the sensor’s measuring range, the display stops at the limit of its range. Above 760 torr, “7.60E+02 torr” is displayed. This does not indicate an error with the sensor! Another possibility is if the sensor is not properly calibrated, the pressure reading signal may incorrectly indicate a pressure outside of the sensor’s measuring range.

Scrolling down two lines results in the Degas status being displayed as shown in Screen 39. The first line displays the current status (the “XXX” is replaced with either “OFF” or “ON” depending on the actual state at the time).

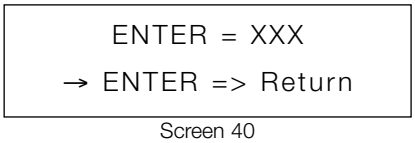


Screen 39

The second line indicates that pressing the ENTER key while the cursor is on this line will change the state of the degas function. For example, if the degas is currently OFF, pressing the ENTER key when the cursor is on the second line as shown in screen 39 will turn the degas function ON, and vice versa.

The degas function is only able to be used when the pressure is less than 5.4x10-6 torr (this is consistent with the requirements of the ITR90 sensor — a combination Pirani and Hot Cathode Ion sensor gauge). The degas will continuefor a maximum of three minutes or until it is turned off manually by pressing the ENTER key again.

Scrolling down one line from that shown in Screen 39, results in the cursor being positioned to exit the sub-menu. Pressing the ENTER key when the cursor is on the line shown in Screen 40 will return control to the main displays.

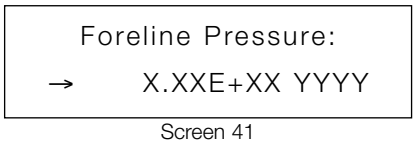


Screen 40

(The escape key — “ESC” — may also be used to exit a menu or sub-menu at any time.)

4.6 Vacuum Sensors—Foreline Sub-menu Display Screens

The “Vacuum Sensors—Foreline“ key is used to display the foreline pressure if the optional foreline TTR90 Pirani sensor is installed.



Screen 41

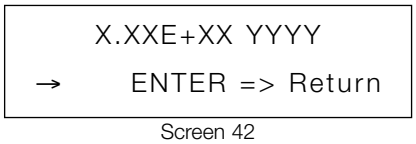
The first information displayed on pressing the Vacuum Sensors—Foreline key is the current pressure as measured by the optional TTR90 foreline sensor. The pressure is displayed in scientific notation (“X.XXE+XX” as shown at left in Screen 41) in the selected units (“YYYY”).

There are two readouts possible with the sensors: the actual pressure or an error message.

With an actual pressure reading, the “X.XXE+XX” as shown in the displays at left is replaced with the actual pressure measured by the TTR90 sensor. The actual pressure is always displayed in scientific notation.

If the sensor is not connected to the controller or there is a problem with the sensor, the display changes to a Warning Screen (see Section 4.8).

Should the pressure be outside the sensor’s measuring range, the display stops at the limit of its range. Above 760 torr, “7.60E+02 torr” is displayed. This does not indicate an error with the sensor! Another possibility is if the sensor is not properly calibrated, the pressure reading signal may incorrectly indicate a pressure outside of the sensor’s measuring range.



Screen 42

Scrolling down one line from that shown in Screen 41, results in the cursor being positioned to exit the sub-menu.

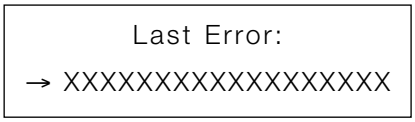
Pressing the ENTER key when the cursor is on the line shown in Screen 42 will return control to the main displays.

(The escape key — “ESC” — may also be used to exit a menu or sub-menu at any time.)

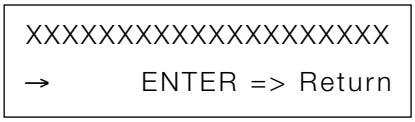
4.7 Last Error Screens

The TURBO.DRIVE Controller ("TDC") stores the last "error" that the TW70H turbopump experiences when it shuts itself down for protection (i.e., "failure" mode). This information is available by pressing the LAST ERROR key. The system controller queries the TDC and displays a message for the last error after interpreting the code returned.

Pressing the "LAST ERROR" key displays a menu that shows the last failure that the pump has experienced.



Screen 43



Screen 44

This can be useful in diagnosing any problems with the operation of the turbopump. Note that the errors associated with this key are not (usually) indicative of a mechanical or electrical failure of the pump itself, but rather a problem with the application or operation of the pump. For instance, shutdown due to too high of a temperature is most likely the result of operating with too high of a gas load or too high of a foreline pressure. Likewise, a failure to reach normal operation speed within the allotted time is due to a leak or too small of a forepump for the volume being pumped on. Once the fault is reset and the cause of the failure removed, the TW70H will operate normally — without need for repair or service.

Pressing ENTER when the cursor is on the line shown in Screen 44 will return to the STATUS main menu, line 1.

(Note that the escape key — "ESC" — may also be used to exit a menu or sub-menu at any time.)

There are eight possible error messages.

Depending on the reason for the failure, one of these will appear in place of the "XXXXXXXXXXXXXXXXXXX" as shown in Screens 43 and 44.

No Failure

The turbopump has not experienced any failures.

Max. Speed Exceeded

The turbopump ran at a speed greater than the set maximum

Max. Passing Time

There is a critical frequency region that the turbopump must pass through in an allowable time of 500 seconds (nominal). This failure message indicates that the turbopump has exceeded that allowable time.

Bearing Overtemp

The maximum temperature of the turbopump bearing has been exceeded.

Short Circuit

A short circuit has occurred in the pump/TDC frequency controller.

Heatsink Overtemp

The maximum temperature of the TDC frequency controller's heatsink has been exceeded.

Accel Time Exceeded

The allowable time for the turbopump to achieve normal operation status has been exceeded.

Motor Overtemp

The maximum temperature of the turbopump motor has been exceeded.

4.8 Warning and Message Screens

Several screens are used to provide information about the operation of the system and its components. These screens are not accessible directly via user actions, but arise in response to actions of the system due to user requests for certain actions — such as the opening or closing of a valve or the starting or stopping of a pump. These screens are displayed automatically.

Please be aware that some of these screens may not be displayed due to other informational screens taking precedence. This occurs due to the timing of the sequence of actions and the length of time needed to display a screen to allow it to be read. If a certain informational screen does not always appear as it seems it should, this does not necessarily indicate a problem but is probably the result of another screen taking precedence.

Forepump...
Energized

Screen 45

Forepump...
Deenergized

Screen 46

The first two screens shown at left display the message that arises when the forepump is told to start and stop. Screen 45 shows the message displayed when the forepump is told to start and Screen 46 shows the message displayed when it is told to stop. As shown in Screen 45, since there is no direct feedback from the forepump as to whether it has actually started, the message notes only that the controller's output has been energized to start the pump. This does not necessarily mean that the forepump has started. It could be that the pump has become disconnected from the controller or there could be a problem with the pump's motor that prevents it from actually running.

Vent Valve
Energized...

Screen 47

Vent Valve
Deenergized...

Screen48

The optional Vent Valve operates in a similar manner to the forepump. There is no feedback from this valve, so the message displayed only refers to the energized or deenergized state of the valve's output relay on the controller. There is a visual indication to the state of the vent valve, however. The connector on the end of the cable that attaches to the vent valve contains a red LED that is lit when the valve is receiving power. When the valve is not receiving power, the LED is not lit. While not visible with the enclosure closed, it is useful in troubleshooting to verify the correct operation of the valve.

CANNOT START!
Vent valve is open!

Screen 49

WARNING! No Pressure
Signal Available!

Screen 50

One of the two screens shown at left would arise if the operator attempted to start the automatic pumpdown sequence and either the vent valve was open (Screen 49) or a pressur signal was not available (Screen 50).

Since the system can't be pumped down with the vent valve open, the automatic sequence is not started and a warning (Screen 49) is displayed. Once the vent valve is closed, the automatic sequence may be started.

Also, the automatic sequence requires a pressure signal to start the turbopump. Without this, a warning (screen 50) is displayed and the automatic program is not started. Once a sensor signal is provided, the automatic sequence may be started.

In the Manual mode, if the operator attempts to start the turbopump without the forepump running, the controller displays a warning (Screen 51). Once the forepump is started, the turbopump may be started.

CANNOT START!
Must start F/P!

Screen 51

If a sensor is not installed or the signal is not being received (or outside of the sensor's limits), a warning screen is displayed when the sensor's front panel control key is pressed. Screen 52 is displayed for the INLET sensor key and Screen 53 is displayed for the FORELINE sensor.

This could mean the sensor is not connected ("N/C") or is non-functional ("Error").

Since only one of the sensors is needed for the automatic program, it is quite likely that only one sensor would be installed. Rather than displaying a blank screen when the sensor's control key is pressed the warning screen is displayed as a reminder that the sensor is not functional.

WARNING! Inlet
Sensor N/C or Error!

Screen 52

WARNING! Foreline
Sensor N/C or Error!

Screen 53

In order to change the operating mode from Automatic to Manual (or vice versa), the PT70 F-Compact controller must be in TSC control mode. A warning screen (Screen 54) is displayed if an attempt is made to change the operating mode while in "LOCAL (X1)" control. Automatic operation mode is only applicable while the turbopump is under the control of the PT70 F-Compact controller (i.e, TSC control). When in LOCAL (X1) mode, the turbopump is not under the control of the TSC, but is being run by direct input to the turbopump's TDC frequency controller. In this instance, switching modes is not applicable and is, therefore, disallowed.

To change mode, must
be in TSC Control

Screen 54

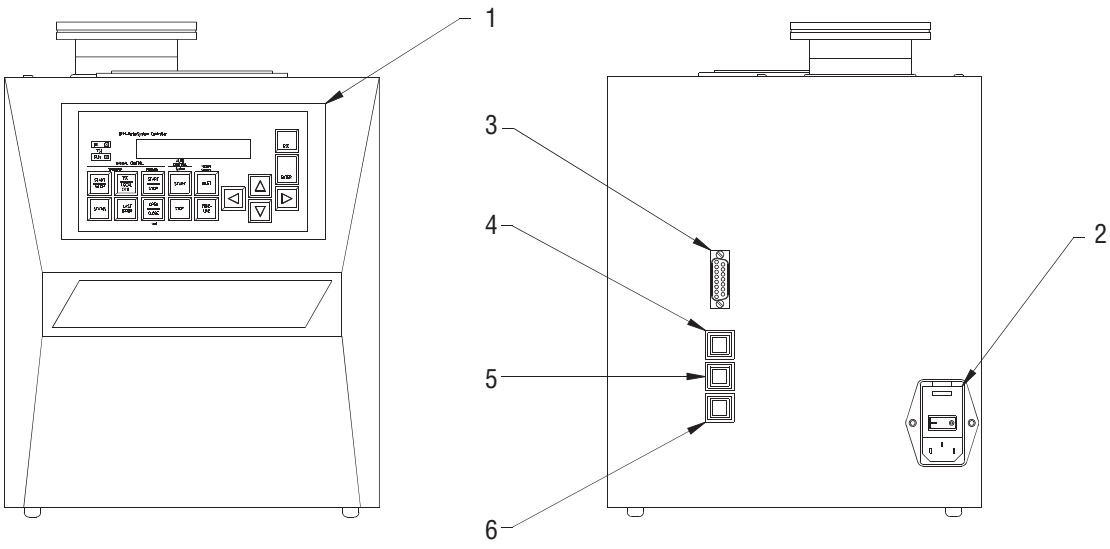
When a request to degas the Inlet ITR90 Hot Cathode Ionization sensor is made, the controller checks the pressure to be sure it is less than an allowable upper limit (5.4×10^{-6} torr). If not, a warning (Screen 55) is displayed. Once the pressure drops below this limit, the sensor may be degassed.

Pressure too High!
See Manual for Limit

Screen 55

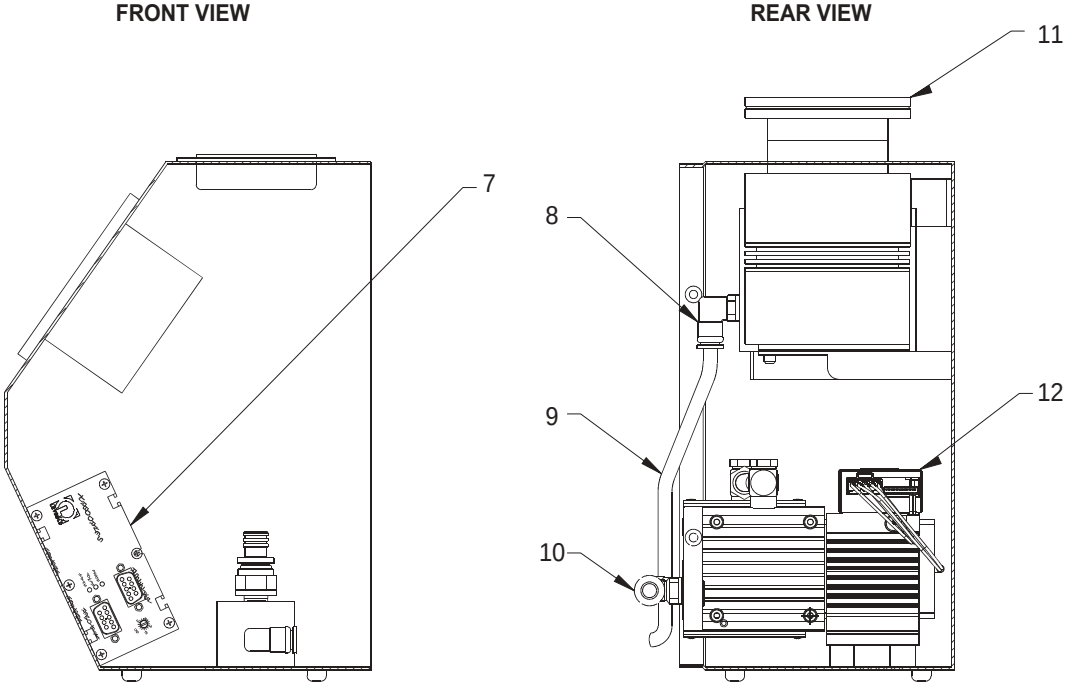
5 Spare parts

Item	Quantity	Description	Part Number
1	1	PT70F-Compact Logig Controller	721 50 139
2	1	Power input module, 250 V, 10 A	722 90 128
3	1	DB 15 connector female: ITR 90 gauge sensor connection	721 38 359
4	1	Circuit breaker, 24 VDC, 3 A: Gauge Sensors, Logic Controller, Vent Valve	721 34 145
5	1	Circuit breaker, 24 VDC, 10 A: Turbopump (TDC)	721 34 144
6	1	Circuit breaker, 24 VDC, 4 A: DIVAC	721 34 146
7	1	TDC = Turbopump Drive (frequency controller) included with pump	(Reference 800072V0001)
8	1	Connector, elbow, G 3/8 BSPP x 8 mm OD tube	725 50 105
9	2	Tubing, Polyethylene, 8 mm OD x 6 mm ID x 254 mm long	722 35 047
10	3	Connector, elbow, G 1/8 BSPP x 8 mm OD tube	725 50 106
11	1	Turbopump, TW 70 H (actual replacement part number depends on flange used; see catalog)	–
12	1	DIVAC diaphragm pump, 13 l/min, 24 VDC	722 92 016
13	1	Foreline Manifold	722 79 600
14	1	Connector, 1/4“ NPT Male x 1/2“ OD Tube	755 50 108
15	1	Plug, 1/2“ OD tube	725 50 112
16	1	Connector, G 1/8“ Male x 8 mm OD Tube	72550 107
17	1	Plug, 8 mm OD tube	725 50 111
18	1	Exhaust silencer, G 1/8 BSPP	724 77 547
19	1	Power supply, 88-132/176-264 VAC input, 24 VDC output, 240 W	190 295 029
20	1	Diode	721 69 013
21a (not shown)	2	Fuse 10 A (for 110 VAC power input), 1 1/4“ x 1/4“, time delay	72195 105
21b (not shown)	2	Fuse 5 A (for 230 VAC power input), 1 1/4“ x 1/4“, time delay	72195 106
22	1	Power cord, 230 VAC, 2 m long	190 127 896
23	1	ITR 90 sensor cable, DB 15 straight through, 5 m long (see catalog for available length)	124 55
24	1	Vent valve, normally Closed, 24 VDC, 8 mm OD tube connection	720 53 113
25	1	TTR90 Pirani Sensor, 1/2“ OD Tube connection	128 13
26	1	ITR 90 combination hot cathode / Pirani sensor (actual part number depends on flange type)	–
–	–	KF25, with integral display readout	12091
–	–	KF25, without display.	12090
–	–	CF40, with integral display readout	12094
–	–	CF40, without display	12092



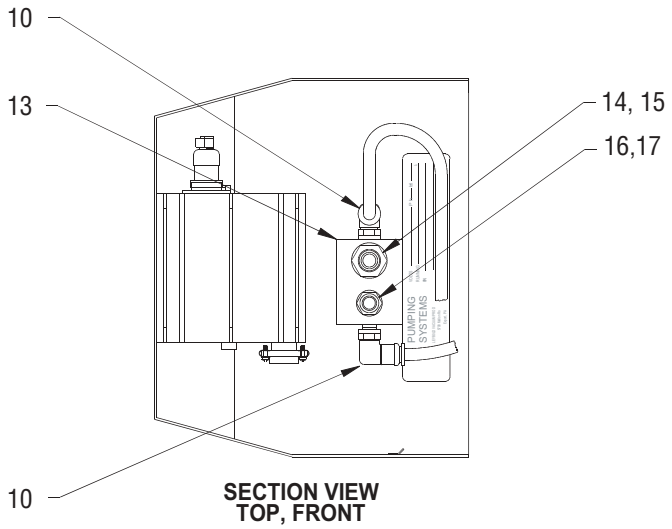
FRONT VIEW

REAR VIEW

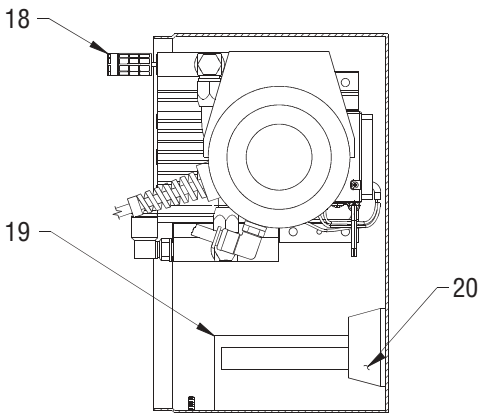


**SECTION VIEW
RIGHT SIDE, FRONT**

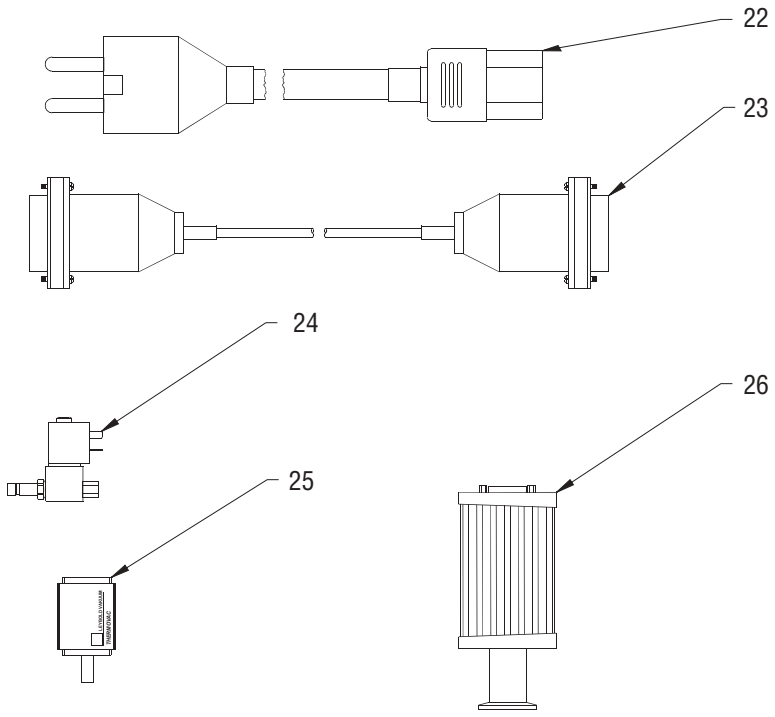
**SECTION VIEW
RIGHT SIDE, REAR**



SECTION VIEW
TOP, FRONT

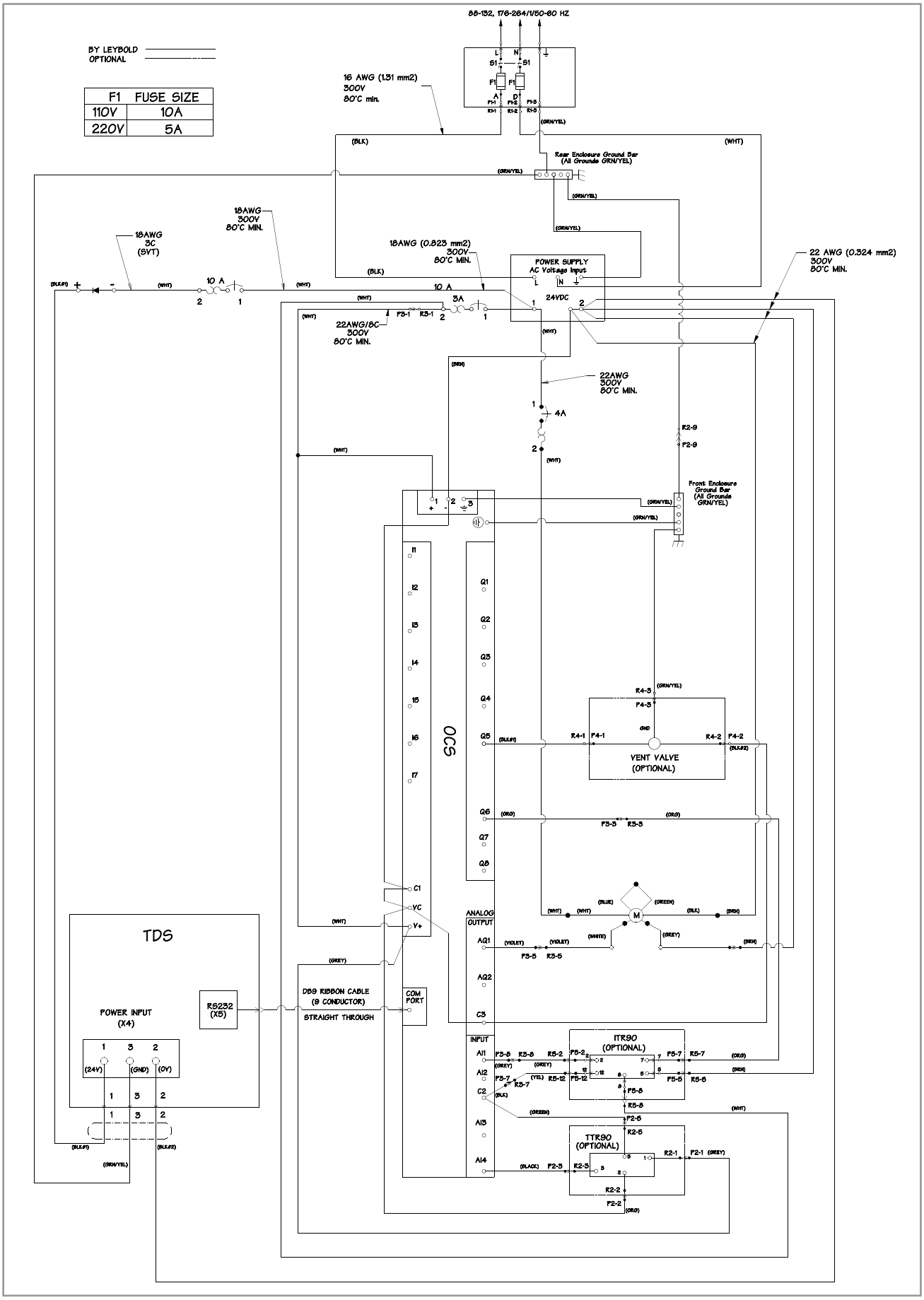


SECTION VIEW
TOP, REAR

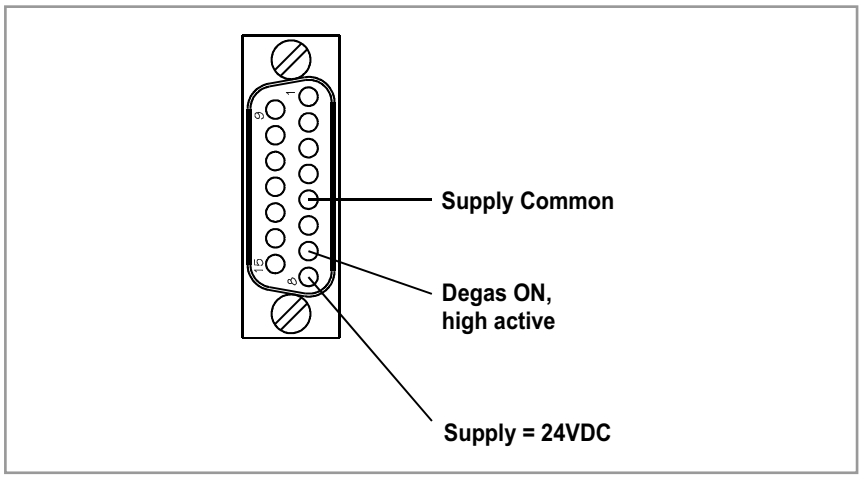


PT70 F-Compact Cables & Accessories

Electrical Schematic



ITR90 Connection Wiring



Notes

EC Conformance Declaration

We, the Leybold Vacuum GmbH, declare herewith that the products listed below, on the basis of their design and engineering as well as in the embodiment which we have placed on the market, comply with the applicable safety and health requirements set forth in EC guidelines.

This declaration becomes invalid if modifications are made to the product without consultation with us.

Designation of the products: Turbomolecular pump system

Models: PT 70 B Compact, PT 70 F Compact,

Part Numbers: 500 002 469 /470 /471 /472

The products comply with the following guidelines:

- EC Machinery Guidelines (98/37/EC)
- EC Low-Voltage Guidelines (73/23/EEC)

Applicable, harmonized standards:

- EN 292-1 and -2 Machinery Safety – Basic Terminology
- EN 1012-2 Safety Requirements for Vacuum Pumps
- EN 60204: Electrical Equipment for Industrial Machinery

Applied national standards and technical specifications:

- DIN 31 001

Cologne, July 14, 2004

Schomisch, Leader CEAS

Cologne, July 14, 2004

Langner, Electrical Engineering

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Leybold vacuum

Declaration of Contamination of Compressors, Vacuum Pumps and Components

The repair and / or servicing of compressors, vacuum pumps and components will be carried out only if a correctly completed declaration has been submitted. **Non-completion will result in delay**. The manufacturer can refuse to accept any equipment without a declaration.

A separate declaration has to be copleted for every single component.

This declaration may be completed and signed only by authorised and qualified staff.

Customer/Dep./Institute: _____

_____

Address _____

_____

Person to contact: _____

Phone: _____ Fax: _____

Order number of customer: _____

Reason for returning ☒ applicable please mark

❑ repair ❑ chargeable ❑ warranty

❑ Austausch ❑ chargeable ❑ warranty

❑ DKD-calibration ❑ Factory calibration

restoring goods because of following reason:

❑ rent/loan ❑ for credit ❑ against exchange

❑ exchange already received/arranged

A. Description of the equipment (machine or component)

Ancillary equipment

Type: _____ _____

Part number: _____ _____

Serial number: _____ _____

Type of oil used: _____ _____

B. Condition of the equipment

	No	Yes	No
1. Has the equipment been used	❑	❑ →	
2. Drained (Product/service fluid)	↓	❑	❑
3. All openings sealed airtight		❑	
4. Purged		❑	❑

If yes which cleaning agent: _____

and which method of cleaning: _____

Contamination:	No	Yes
toxic	❑	❑
corrosive	❑	❑
microbiological	❑	❑
explosive	❑	❑
radioactive	❑	❑
other harmful substances	❑	❑

C. Description of processed substances (Please fill in absolutely)

1. What substances have come into contact with the equipment:
Trade name and / or chemical term of service fluids and substances processed, properties of the substances; According to safety data sheet (e.g. toxic, inflammable, corrosive, radioactive)

	Tradename:	Chemical name:	Residues:
a)	_____	_____	❑ Yes ❑ No
b)	_____	_____	❑ Yes ❑ No
c)	_____	_____	❑ Yes ❑ No
d)	_____	_____	❑ Yes ❑ No

	Yes	No
2. Are these substances harmful?	❑	❑
3. Dangerous decomposition products when thermally loaded	❑	❑

Which:

Components contaminated by microbiological, explosive or radioactive products will not be accepted without written evidence of decontamination.

D. Legally binding declaration

I / we hereby declare that the information supplied on this form is accurate and sufficient to judge any contamination level.

Name of authorised person (block letters): _____

date _____ signatur of authorised person _____

firm stamp

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